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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/658,732 | 09/11/2000 | Makoto Inai | P/1071-1118 | 4527 |

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EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 05/20/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|---|--|------------------------------------|
| Office Action Summary | Application No. 09/658,732 | Applicant(s) Inai et al. |
| | Examiner B. William Baumeister | Art Unit 2815 |
| <i>-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --</i> | | |
| Period for Reply A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION. | | |
| - Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication. | | |
| - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely. | | |
| - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication. | | |
| - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). | | |
| - Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b). | | |
| Status | | |
| 1) <input checked="" type="checkbox"/> Responsive to communication(s) filed on <u>Feb 19, 2002</u> | | |
| 2a) <input checked="" type="checkbox"/> This action is FINAL. 2b) <input type="checkbox"/> This action is non-final. | | |
| 3) <input type="checkbox"/> Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under <i>Ex parte Quayle</i> , 1935 C.D. 11; 453 O.G. 213. | | |
| Disposition of Claims | | |
| 4) <input checked="" type="checkbox"/> Claim(s) <u>1-12</u> is/are pending in the application. | | |
| 4a) Of the above, claim(s) _____ is/are withdrawn from consideration. | | |
| 5) <input type="checkbox"/> Claim(s) _____ is/are allowed. | | |
| 6) <input checked="" type="checkbox"/> Claim(s) <u>1-12</u> is/are rejected. | | |
| 7) <input type="checkbox"/> Claim(s) _____ is/are objected to. | | |
| 8) <input type="checkbox"/> Claims _____ are subject to restriction and/or election requirement. | | |
| Application Papers | | |
| 9) <input type="checkbox"/> The specification is objected to by the Examiner. | | |
| 10) <input type="checkbox"/> The drawing(s) filed on _____ is/are a) <input type="checkbox"/> accepted or b) <input type="checkbox"/> objected to by the Examiner. Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a). | | |
| 11) <input type="checkbox"/> The proposed drawing correction filed on _____ is: a) <input type="checkbox"/> approved b) <input type="checkbox"/> disapproved by the Examiner. If approved, corrected drawings are required in reply to this Office action. | | |
| 12) <input type="checkbox"/> The oath or declaration is objected to by the Examiner. | | |
| Priority under 35 U.S.C. §§ 119 and 120 | | |
| 13) <input type="checkbox"/> Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f). a) <input type="checkbox"/> All b) <input type="checkbox"/> Some* c) <input type="checkbox"/> None of: 1. <input type="checkbox"/> Certified copies of the priority documents have been received. 2. <input type="checkbox"/> Certified copies of the priority documents have been received in Application No. _____. 3. <input type="checkbox"/> Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)). *See the attached detailed Office action for a list of the certified copies not received. | | |
| 14) <input type="checkbox"/> Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e). a) <input type="checkbox"/> The translation of the foreign language provisional application has been received. | | |
| 15) <input type="checkbox"/> Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121. | | |
| Attachment(s) | | |
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | | |
| 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ | | |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | | |
| 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) | | |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ | | |
| 6) <input type="checkbox"/> Other: _____ | | |

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DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 8, 11 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Inai et al. "Doped Channel HFET..." (Supplied in IDS #5). Inai discloses a DC-HFET that comprises an n-InGaAs channel; a "semiconductor structure" comprised of an n-AlGaAs intermediate layer adjacent the contact, an undoped AlGaAs barrier layer and a lightly doped n-GaAs layer adjacent the InGaAs channel; and n-GaAs contact double layer. (See pg. 328, 2nd paragraph and FIG 1.) Regarding claims 11 and 12, the Schottky gate electrode is in contact with the undoped AlGaAs portion of the barrier.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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4. Claims 3-7, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Inai et al, as applied to the claims above. Inai teaches all of the structural layers recited in the claims and anticipates the compositional and doping limitations relating to the claims set forth above, including that the intermediate AlGaAs layer is doped above 1 E 18 (pg. 328, col. 1). But Inai does not anticipate the cited claims because the n-doped layer of the double barrier is composed of GaAs that is doped to less than 1 E 17, as opposed to AlGaAs doped to at least 1 E 18 as set forth by the claims.

a. Inai teaches that the doping level of the n-GaAs barrier layer is limited to achieve enhancement mode operation (pg 328, col. 1, first paragraph). It would have been obvious to one of ordinary skill in the art at the time of the invention to have increased the doping level of the doped barrier layer to above 1 E 18 for the purpose of alternatively achieving depletion mode operation. It would have further been obvious to one of ordinary skill in the art at the time of the invention that increasing the doping level in this manner would shift the conduction band of the barrier downward, thereby reducing the bandgap change at the heterointerface between the barrier and the InGaAs channel. As such, one skilled in the art would have been further motivated to substitute AlGaAs for GaAs for the purpose of compensating for this downward band shift by increasing the barrier's bandgap and thereby restoring a larger bandgap at the channel-barrier heterointerface, thereby better ensuring the confinement of the carriers at this interface.

b. Regarding the limitation of these claims that the barrier is formed of a "single material," the Examiner notes that the broadest reasonable interpretation would read on three

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layers of AlGaAs (i.e., the intermediate and double barrier layers), regardless of whether the Al:Ga ratios of the three sublayers are the same. However, for the sake of compact prosecution, assuming *arguendo* that “single material” must be read more narrowly to mean that the ratios of the three sublayers must all be the same (i.e.: that the only difference in the intermediate/double-barrier sublayers’ compositions is the doping level), given that it would have been obvious to one skilled in the art at the time of the invention to form the lower barrier layer of more heavily doped AlGaAs, it would have further been obvious to one skilled in the art to make the three sublayers of the same specific AlGaAs composition for the purpose of simplifying the design calculations and the manufacturing process by eliminating the need to repeatedly readjust the growth rates of the Al and Ga in addition to controlling the impurity doping rate.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR

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1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

INFORMATION ON HOW TO CONTACT THE USPTO

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister**, at (703) 306-9165. The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

B. William Baumeister

Patent Examiner, Art Unit 2815

May 15, 2002



EDDIE LEE
SUPERVISORY PATENT EXAMINER
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